alarm system because we want frequent tornadoes, but quite on the contrary because we do not, but want to be forewarned when there is one.

The Weather Bureau officials deserve credit for the work that they have done in giving us facts and figures to work from, as well as the many wonderful discoveries they have made. They have taken an uneducated people which had all kinds of superstitious ideas in regard to foretelling the pending weather, based on myths and old traditions, until after a process of evolution and hard work on their part we have now a Weather Bureau superior to any in the world. They educated themselves while educating the masses until they have reached this state of proficiency. All this has been accomplished within the last forty years, and if these same persons are kept in charge of this work, I believe our Bureau will advance as much within the same time in the future. While there is life there is room for progress.

I have read your articles in the WEATHER REVIEW and have gained much information in regard to lows and highs and the conditions accompanying them, and it seems to me that there is not much work left undone. I also read what you write with special interest, because it impresses me that you are dealing with facts as you find them regardless of what theory they may upset or uphold; like all true scientists, you are seeking the truth.

I am only a beginner, and any suggestions and information that you will kindly give will be appreciated. I am open to conviction and believe that we all should so school ourselves as to be able at the end of each period to slough off the skin of preference or prejudice that may have hardened itself around us during the last period.

(4) REPLY SENT TO SECOND LETTER BY EDITOR.

In reply to yours of July 27 I may thank you for saying that the Weather Bureau deserves credit for the work it has done in giving facts and figures, and educating the people above superstitions and errors in regard to the weather; but our efforts to benefit the people will be in vain if, in spite of our facts and figures, you create an unnecessary dread or fright with regard to tornadoes in your locality. I see no reason to believe that your system of telegraph line and automatic signals will give any reliable forewarning of a tornado; and should advise you and the city not to waste money on it. You state your belief that only a small per cent of tornadoes do damage at the earth's surface, in your State, and the rest do not reach the ground. You also add that you can not give any additional information about tornadoes, because the public generally call them *cyclones*. Neither of these ideas is true; the use of two terms, "tornado" and "cyclone," need not produce any confusion in the statistics of frequency. The tornadoes that do damage at the earth's surface are the only ones that need to be counted in any efforts that you make to provide against them; and, as I wrote before, *these* are so rare that a region four miles square need not expect to have more than one in ten thousand years. If you count every destructive wind and every imaginary tornado far above the ground in the dark and threatening clouds as a proper reason for fright and anxiety, you will produce a wholly unnecessary state of uneasiness and alarm in the community.

You say there is no expense you would not undergo to protect your life, but you do not protect it efficiently by your telegraph line and forewarnings of tornadoes. The chance of your dying from a tornado is not the ten-thousandth part of your chance of dying from disease, accident, lightning, etc., and it would be a wiser policy to spend your money to protect yourself against these. The mere forewarning of a tornado is no protection against its coming.

THE OBSERVATORY ON MOUNT ETNA.

Under date of May 16, 1907, at Messina, Sicily, Prof. G. B. Rizzo, the director of the observatory recently built near the summit of Mount Etna, wrote that he was about to start for the summit and to occupy the observatory there for the summer, where he would make a series of observations on the intensity of solar radiation, as measured by means of the Ångström pyrheliometer. This instrument is a duplicate of that which has been used for the past five years by Mr. H. H. Kimball, and on account of the special interest taken in this subject by American students Professor Rizzo proposes to communicate his results for publication in the MONTHLY WEATHER REVIEW.

The importance of continuous meteorological work on mountain summits is felt more and more as our knowledge of meteorology progresses. The balloon work and kite work must be supplemented by regular mountain stations; these latter are practicable and inexpensive where balloon work would be impracticable. There are many noble peaks on ocean islands that still remain to be occupied, and even if they can not be occupied immediately, yet the cloud phenomena about their summits should be systematically observed.

The following description of the ascent of Mount Etna is abbreviated from an account by Maj. Albert Woodcock, formerly United States Consul at Catania, Sicily, whose letter was published in the Sportsman Tourist, Vol. LXI, New York, July 25, 1903, which contains much interesting information, but we have omitted that which is not appropriate to the MONTHLY WEATHER REVIEW.

At 3 o'clock a. m. of August 14 last (1886), a large carriage drawn by two stout horses left Catania to make the ascent of Mount Etna and the descent into Val del Bove. A hammock beneath the carriage and a boot at the rear contained blankets, rugs, overcoats, and rations for a two days' campaign. We were soon looking down upon Catania with its thousands of lights, and upon the beautiful sea.

The moon was at its full. As we ascended the air grew fresher and more bracing; it had been uncomfortably warm in Catania when we left. We were ascending thru a highly cultivated region. Orchards of orange, lemon, almond, and fig and vineyards of grape grow luxuriantly upon the slopes. In an hour and a half we had ascended to Gravina, an unimportant village of low, lava-constructed houses. Two miles higher up we reached the quaint old town of Mascalucia. Perched high up on the side of Mount Etna, it commands fine views of the sea and landscape below. There twilight commenced to steal upon us, and the morning star that had glowed with unusual brilliancy above the Calabrian peaks began to pale. Still higher up we reached the lava village of Torredi Grifo. We were now above the orange belt. In this high altitude in winter are heavy frosts and frequent snows. We now entered upon a barren waste of lava bed, which marks the eruption of 1527.

We arrived at Nicolosi, 2,265 feet above the sea, at 6 o'clock, a. m. Nicolosi is an earthquake-riven town, and has several times been shaken to the ground. The lava flood of May last approached within 1,000 feet of it. It there stands a black, hideous mass, still hot and sending off sulphurous vapors. We rested at Nicolosi for an hour, refreshing ourselves with cold coffee, bread, and cheese.

Signor Orazio Silvestri, professor of chemistry, geology, and mineralogy of the Royal University of Catania, courteously tendered us the use of the observatory. The direct road of ascent is covered by the lava flood of May last from 20 to a 100 feet deep. We were obliged to make a detour around this hideous field of black desolation. We flanked Monti Rossi (the Red Mountains) on the south.

Soon after leaving the Red Mountains, we came to a spur of the lava bed of May last. It was insufferably hot. Our mules quickened their pace in crossing. We had left the cultivated region at Nicolosi and were now entering the wooded belt. The trees were mostly of a young growth of chestnuts. Wood being in great demand, the trees were cut before they reach the ordinary size. In this same wooded region, however, on the west side of Mount Etna, there are several monarchs of the forest that have escaped the woodman's ax. They are said to be the oldest trees living and are without doubt 1,000 years old.

Our ascent was very slow and tiresome to the mules. The last May eruption had covered the ground with volcanic sand. The trees seemed to rise from a black sandy desert, there being no green thing visible but their ramage. We reached Casa del Bosco (House of the Woods) at 10 o'clock a. m., tired and voraciously hungry. We were now at an altitude of 4,216 feet above the sea. Casa del Bosco is the last resting place before the final climb to the summit.

The ascent became steeper and more difficult. We wound around the east side of Mount Castello and ascended between Monti Agnuolo and Frumento. We were above the habitable zone. All appearances of vegetation had ceased. No bird fluttered by us, no cricket chirped. There were no signs of animal or insect life. All about us was black desolation. Sun-lit clouds were hanging upon the crests below us. Our way was over black volcanic sand and loose boulders of lava. We were soon upon Piano del Lago (the plains of the lake). Lava floods have filled it, and it has ceased to be a lake.

Casa Inglese is 9,652 feet above the sea. It is situated at the base of the great cone. It was erected in 1811 by some officers of the British Army; the English at that time occupied Sicily. It is a low one-story building, constructed of lava rock, and stands east and west; in one of the three rooms is a fireplace. This building is the refuge of excursionists to Etna. The observatory now (1886) is a low two-story building surmounted by a dome. It is built of lava rocks, the walls being of unusual thickness, to withstand the frequent shocks of earthquake. It is joined to Casa Inglese, the latter being a lean-to on the south to the former. A telescope and all other instruments requisite for making observations in astronomy, meteorology, etc., have been purchased and will soon be mounted in the building. Owing to the kindness of Professor Silvestri (as before stated) we were in possession of the observatory. Here we found beds, bedding, table, chairs, etc., designed for the use of the scientists; these, for the time being, were ours, and we were supremely comfortable. After an hour's rest our company mustered for the ascent of the great cone. It towered into the heavens 1,200 feet above us, its sides being very steep.

We finally reached the north rim of the crater. The grand old sea and the Calabrian peaks lay outstretched before us. Sun-lit clouds in great

billows were floating below us. These, tho wonderfully beautiful, dyed in the rich colors of the declining sun, shut off the greater portion of the island from our view. On my previous visit to Etna, in May, 1884, the atmosphere was much clearer. Then we could see the greater part of the island. The entire east coast was outstretched below us. The billows of the sea breaking upon the rocky coast gave it a silvery edging. Two cities and a vast number of villages and hamlets incrusted the seashore, dotted the valleys, and nestled on the hillside. The Sicilian Mountain chains rose about us in great irregular ridges, crest peeping over crest. Stromboli to the north (seemingly but a stone's throw away), protruded his rocky head and shoulders above the sea. He was throwing a dense column of black smoke thousands of feet into the heavens. Adjacent was the little island volcano throwing upward white puffs of clouds. Mount Etna at the same time was shooting upward an immense column of sulphurous steam, rendering it impossible to see much of the interior of the crater. An inky black cloud hung below us at the west. From it came zig-zag chains of lightning flashes and thunder peals. We looked down upon the storm; it was raining below us, but we were in the sunshine above.

When the heavens are free of clouds the whole island, with its innumerable mountain peaks, is visible from the rim of the crater. With a glass the waves of the sea may be seen breaking in foam upon the rocky coast of the entire island. Malta is visible in the south, Stromboli and the Lipari Islands to the north, the Aegedian Islands to the west, and the three great seas of the Mediterranean—the Ionian, the African, and the Tyrrhian.

The sun was low down in the west and seemed to swim in a sea of glory. A stratus of clouds lay low in the heavens shutting off all view from the west. The stratus did not resemble clouds, but looked like a vast sea flecked with gold by the setting sun. As the sun neared the western horizon, it cast a great purple shadow of Etna against the eastern sky. It was triangular shaped and seemed to hang vertically in the heavens. For a time the rising moon shone with its silver light in the very apex of the purple pyramid. It was the strangest and most beautiful scene my eyes ever beheld.

DUSTFALL IN IDAHO.

Under date of April 18, 1908, Mr. F. Roch, the special observer of Wallace, Idaho, writes:

Twice within the past ten days we have had rainfalls so heavily charged with dust—the dust in dry form falling in flakes the size of a pinhead—that they might be called dustfalls instead of rain. These specks of dust came down as straight as it would be possible for a gentle rain to fall, and the fall continued for several hours intermittently.

This large quantity of dust must have had a special origin nearby and we hope that Mr. Roch will trace it to its source.—EDITOR.

METEOROLOGICAL EDUCATION.

In connection with the statistics of educational work by Weather Bureau officials, the editor would be glad to know of stations at which such work could be done more satisfactorily than now if some one especially fitted as teacher were attached to the local office force. Of course the teaching is only a small part of the official work, but it is well to have it done creditably to the Bureau. The subject is really so important and so interesting that we think colleges and academies will certainly take pride in being pioneers in the work.—EDITOR.

THE LAW OF THE EARTH'S NOCTURNAL COOLING.

By Prof. WILLIAM H. JACKSON. Dated Haverford College, Haverford, Pa., May 13, 1908.

In 1872 A. Weilenmann[1] showed that the normal temperature curve from sunset to sunrise may be represented by a formula appropriate to the Newtonian rate of cooling, that is by

$$\theta = \theta_0 + C\,b^t \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where t denotes the time measured in hours from midnight, θ the temperatures at time t, and θ_0, C, b are constants chosen to fit the observations as well as possible. Further, he found the striking agreement between the values of b for different places, as shown in the following table:

TABLE 1.—*Values of b for different places.*

Place.	Log b.	Duration of observations, in years.
Hobarton	$\bar{1}.934$	8
Berne	$\bar{1}.935$	7
Great St. Bernard	$\bar{1}.936$	19
St. Peterburg	$\bar{1}.938$	16
Ghent	$\bar{1}.939$	24
Prague	$\bar{1}.939$	13
Toronto	$\bar{1}.940$	6
Batavia	$\bar{1}.942$	3

In 1888 M. Alfred Angot[2] found that the corresponding values of log b for St. Maur, near Paris, were $\bar{1}.940$ for clear nights and $\bar{1}.936$ for cloudy nights. This is an independent confirmation of Weilenmann's results, and seems to show what might perhaps be inferred from those previous results, that the value of b is practically independent of the state of the atmosphere.

I was informed of these facts early in 1906, when Prof. Arthur Schuster drew my attention to a paper by Dr. S. Tetsu Tamura,[3] which gives an excellent account of the whole subject. At the same time he suggested that the facts could probably be explained by supposing that the earth radiated like a black body and that the question might be treated as one of heat conduction.

Attempts to treat the matter theoretically only led to two negative conclusions. First: It is unlikely that such a law can represent the actual facts, because such a law implies a solution of the differential equations to be solved of the form

$$\theta = f(x)\, e^{-kt},$$

where x denotes the distance from the surface of the earth. Such a law as this implies that all temperatures are decreasing at the same rate; whereas we know that the relative temperatures of the earth and atmosphere vary considerably in the course of the night. Secondly: If such a law represented the state of affairs, the coefficient b would vary from place to place, according to the nature of the ground.

Or we may look at the question from a purely theoretical point of view. Following Riemann,[4] the solution of the problem of the cooling of a very large conducting sphere, originally everywhere at unit temperature, and radiating heat into space at a rate proportional to the constant h, allows the surface temperature to be exprest by the formula,

$$\theta = 2\pi^{-\frac{1}{2}} h e^{a^2h^2t} \int_{a\sqrt{t}}^{\infty} e^{-h^2s^2}\, ds \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where a is the diffusivity of the sphere. Extending this formula to the case of a sphere normally in a steady state of heat flow, but which has been subjected to a uniform increase of temperature, and which is then left to return to its original normal condition, we obtain the series,

$$\theta = \theta_0 + \theta' (1 - 2\pi^{-\frac{1}{2}} ah t^{\frac{1}{2}} + a^2h^2t + \tfrac{2}{3}\pi^{-\frac{1}{2}} a^3h^3t^{\frac{3}{2}} + \ldots\ldots) \ldots (3)$$

To obtain a more approximate solution for the actual case of the earth, we should of course suppose that the disturbance from the normal state was not a uniform increase of temperature, but a complicated function, decreasing as the distance below the surface of the earth increases. I have not thought it worth while to attempt this, because as explained, later, I believe the problem is best attacked by other methods.

[1] Ueber den täglichen Gang der Temperatur in Bern. Schweizerische Meteorologische Beobachtungen. Band IX. 1872.

[2] Influence de la Nébulosité sur la variation diurne de la température à Paris. Annales du Bureau Central. 1888.

[3] Mathematical Theory of Nocturnal Cooling of Atmosphere. Monthly Weather Review, April, 1905.

[4] Partielle Differentialgleichungen und deren Anwendung auf physikalische Fragen. Par. 69, 3d Edit. 1882. The same result is obtained by a different method by Carslaw, Fourier's Series and Integrals. 1906. P. 246.